KEPCO

SWITCH-MODE POWER SUPPLIES

RMX

Model RMX 24-D

Serial No. . . . . .

instruction manual

The KEPCO equipment described in this instruction manual is of proprietary design, and is licensed under the United States patent rights of Forbro Design Corp.

The contents of this instruction manual are copyrighted. Reproduction of any part may only be made with the specific written permission of KEPCO, Inc. Data subject to change without notice.

KEPCO®

©1978, Kepco, Inc.

KEPCO, INC. · 131-38 SANFORD AVENUE · FLUSHING, N.Y. 11352 U.S.A. · (212) 461-7000 · TWX #710-582-2631 · Cable: KEPCOPOWER NEWYORK

TABLE OF CONTENTS

PARAGRAPH		PAGE
	SECTION I – INTRODUCTION	
1-1	Scope of Manual	1-1
1-3	General Description	1-1
1-8	Specifications, Electrical	1-3
1-9	Miscellaneous Features	1-4
1-10	Mechanical Specifications	1-4
	SECTION II – INSTALLATION	
2-1	Unpacking and Inspection	2-1
2-3	Terminations	2-1
2-4	Source Power Requirements	2-2
2-5	Source Power Turn-on/Turn-off	2-2
2-8	Preliminary Check-out Before Installation	2-3
2-10	Installation and Cooling Requirements	2-3
	SECTION III – OPERATION	
3-1	General	3-1
3-3	Safety Grounding	3-1
3-6	Signal Grounding	3-1
3-10	Power Supply/Load Interface	3-1
3-14	Load Wire Selection	3-2
3-16	Load Connections	3-2
3-18	Series Operation of RMX	3-4
3-21	Parallel Operation of the RMX	3-5
3-24	Multiple Parallel Connection of RMX Supplies	3-7
3-29	Internal Adjustments and Calibrations	3-10
	SECTION IV – ELECTRICAL PARTS LIST AND DIAGRAMS	
4-1	General	4-1/4-2
4-3	Ordering Information	4-1/4-2

LIST OF ILLUSTRATIONS

FIGURE		PAGE
1-1	Kepco RMX Switch Mode Power Supply	iii/iv
1-2	Block Diagram, RMX Power Supply	1-1
1-3	Mechanical Outline Drawing	1-5/1-6
2-1	Terminations, Kepco RMX Power Supplies	2-1
2-2	Conventional and Remote Source Power Turn-on/Turn-off	2-2
2-3	Connections for the Preliminary Check-out	2-3
2-4	Recommended Mounting Method for RMX Groups D and N Power Supplies (Horizontal)	2-4

LIST OF ILLUSTRATIONS (cont'd.)

FIGURE		PAGE
3-1	Typical Output Impedance VS. Frequency Plot for Stabilized D-C Voltage Sources	3-2
3-2	Load Connection, Without Error Sensing, RMX Groups D and N	3-3
3-3	Load Connection, With Error Sensing, RMX Groups D and N	3-3
3-4	Series Connection of RMX Power Supplies With Error Sensing at the Common Load	3-4
3-5	Parallel Connection of Two RMX Power Supplies	3-6
3-6	Three (3) RMX Power Supplies Connected in Parallel	3-9
3-7	Test Set-up for Current Limit and Overvoltage Limit Adjustments	3-11/3-12
4-1	Component Location Drawing, RMX Groups D and N	4-13/4-14
4-2	Schematic Diagram, RMX Groups D and N.	4-15/4-16

LIST OF TABLES

TABLE		PAGE
1-1	D-C Output Ratings, RMX Groups D and N	1-3
1-2	Stabilization and Ripple, RMX Groups D and N	1-3
2-1	Terminations, Kepco RMX Groups D and N Power Supplies	2-1

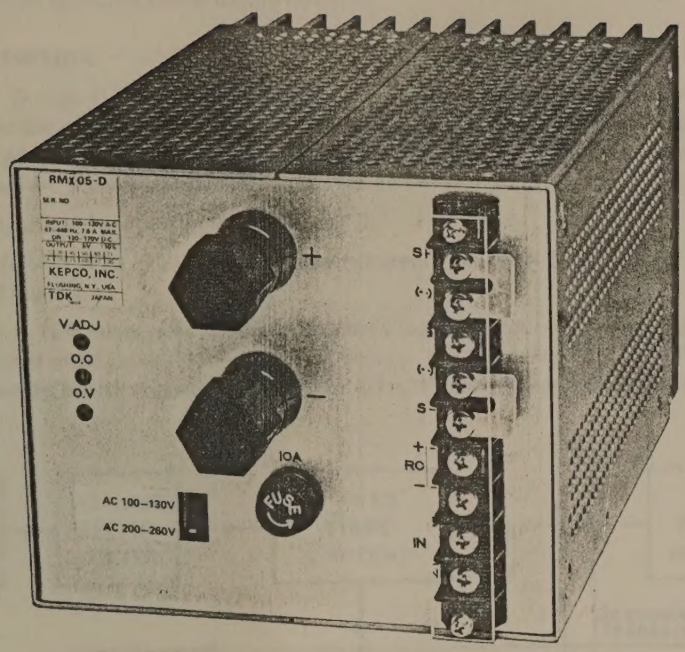


FIG. 1-1 KEPCO RMX SWITCH MODE POWER SUPPLY.

SECTION I – INTRODUCTION

1-1 · SCOPE OF MANUAL

1-2 This manual contains instructions for the installation, operation and maintenance of the KEPCO RMX GROUPS D and N, switch-mode stabilized power supply modules.

1-3 GENERAL DESCRIPTION

1-4 The Kepco RMX Groups D and N power supplies are general purpose, highly efficient, voltage stabilized d-c sources with adjustable output current limit and overvoltage protection. RMX power supplies are low-dissipative stabilizers using switching devices to control the output power. They can be operated from a-c single phase power lines, or from d-c sources as specified in par. 1-8.

1-5 RMX power supply power ratings are given in Table 1-1.

1-6 The BLOCK DIAGRAM (FIG. 1-2) describes those features of the RMX Groups D and N Power Supplies which are common to all models.

a) The A-C FILTER suppresses the high frequency noise introduced by the source and protects the line from reflected noise generated in the power supply. The A-C LINE RECTIFIER converts the line power into the raw d-c source applied to the POWER STAGE operating in a driven switch mode.

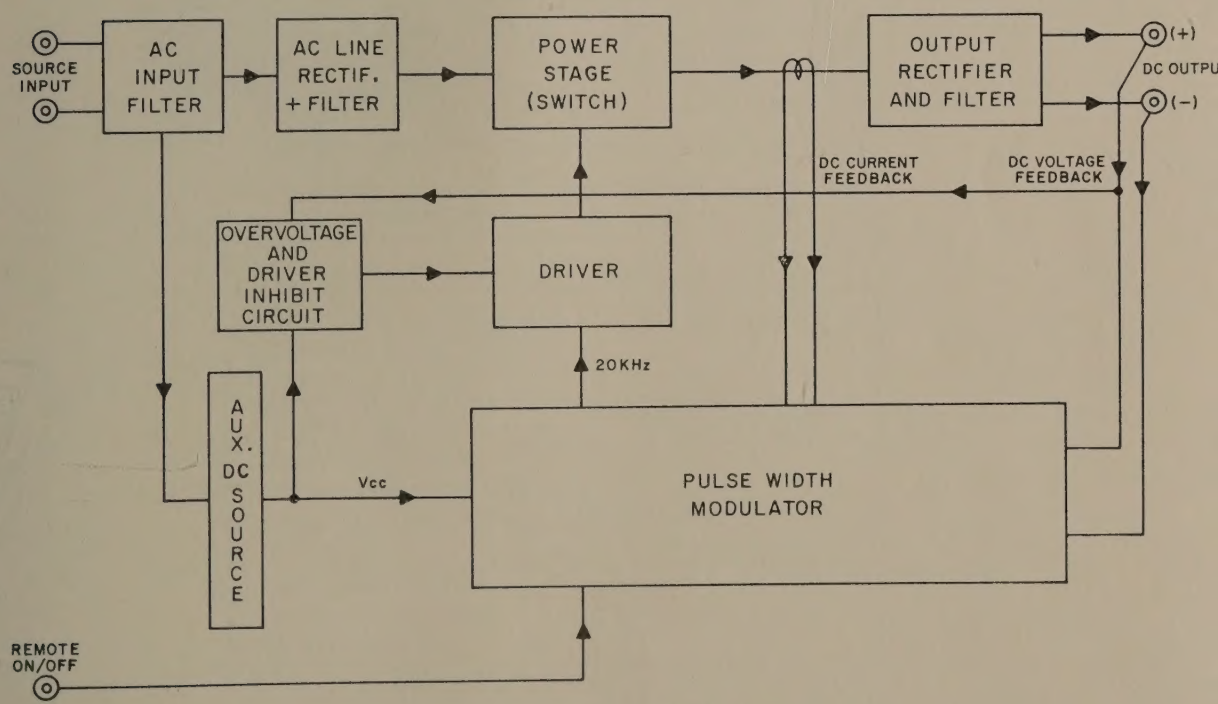
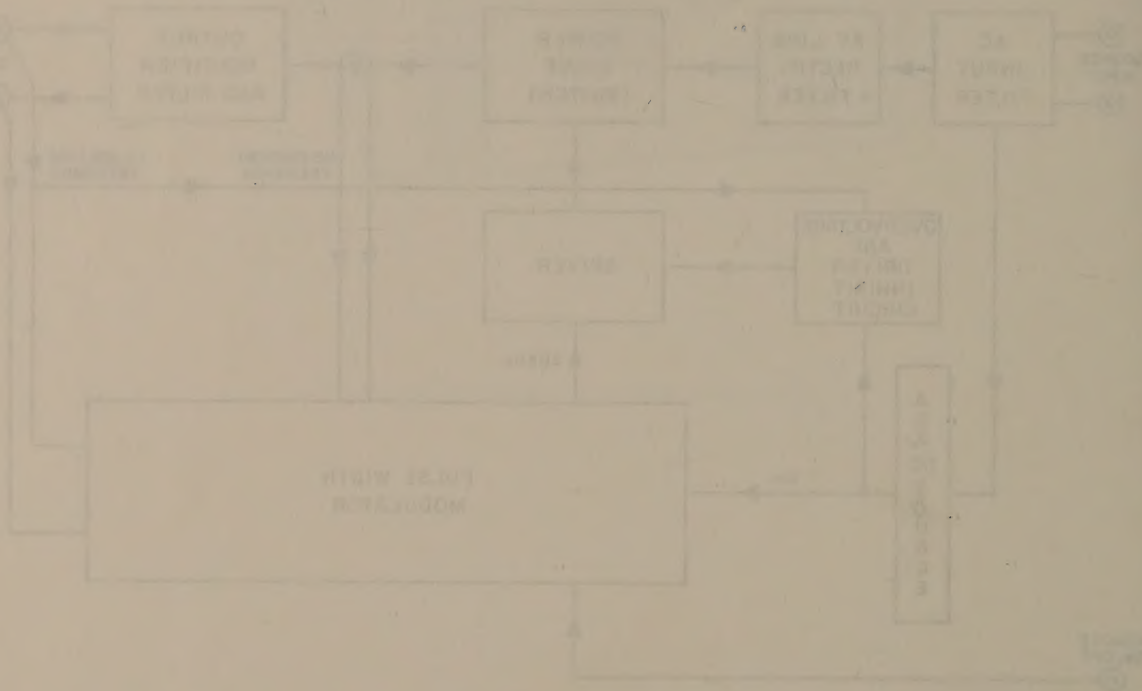


FIG. 1-2 BLOCK DIAGRAM, RMX GROUPS D AND N POWER SUPPLIES.

b) The AUXILIARY D-C SOURCE provides the operating potential for the PULSE-WIDTH MODULATOR, the OVERVOLTAGE CIRCUIT, the DRIVER stage and the REMOTE TURN-ON/OFF stage.



c) The PULSE WIDTH MODULATOR is an integrated circuit, which contains the control circuitry. It contains a ***voltage reference, voltage mode*** and ***current limit error amplifiers, an oscillator, pulse width modulator, pulse steering flip-flop*** and ***dual output switching transistors.*** In the voltage mode of operation, the PULSE WIDTH MODULATOR provides a 20 KHz pulse train to the DRIVER STAGE. The pulse width of the pre-driver pulses is controlled by the D-C VOLTAGE FEEDBACK from the output terminals of the RMX power supply, this providing voltage stabilization. In the event of an overcurrent or a short-circuit, the D-C CURRENT FEEDBACK from the current sensing coil activates the current limiter, which takes control away from the voltage mode amplifier, thus keeping the pre-driver pulse width, and thereby the output current, at a pre-determined constant level.

d) The DRIVER stage accepts the modulated pulses from the PULSE WIDTH MODULATOR and in turn provides the base drive for the POWER STAGE. The POWER STAGE delivers the output power, via the secondary of the power stage transformer and the OUTPUT RECTIFIER/FILTER stage.

e) Protection against overvoltage is provided by the OVERVOLTAGE/DRIVER INHIBIT circuit, which removes the modulated pulse from the DRIVER stage in case of an overvoltage sensed at the (+) output terminal, and inhibits the DRIVER stage on turn-on until the auxiliary voltage reaches its operating level.

1-7 The RMX power supply is constructed in a compact aluminum case (see FIG. 1-3 "Mechanical Outline Dwg." for dimensions and finish). Single board construction provides ready access to all components after cover removal.

1-8 SPECIFICATIONS, ELECTRICAL

A) A-C SOURCE INPUT: 100 to 130V a-c or 200 to 260V a-c (Selectable, see Section II) 47 to 440 Hz, single phase. Maximum a-c current (@ 100V a-c input, 30°C Load per Table 1-1): 9A rms (RMX–D Group), 7A rms (RMX–N Group).

B) D-C SOURCE INPUT: 260 to 340V d-c. Maximum d-c input current (@ 200V d-c input, 30°C Load per Table 1-1): 2.75A d-c (RMX–D Group), 1.75A d-c (RMX–N Group).

C) D-C OUTPUT VOLTAGE: See Table 1-1. D-C OUTPUT CURRENT: See Table 1-1.

Note: RMX models will operate down to 90V a-c (115V a-c Source) or 180V a-c (230V a-c Source) and 234V d-c with minor performance degradation.

RMX	VOLTS	OUTPUT CURRENT – AMPS VS. TEMPERATURE 30°C	40°C	50°C	60°C	71°C
RMX 05–D	3.5–5.5	70.0	70.0	60.0	42.0	30.0
RMX 09–D	6.3–9.9	37.0	37.0	32.0	24.0	16.0
RMX 12–D	8.4–13.2	32.0	32.0	27.0	19.0	11.0
RMX 15–D	10.5–16.5	27.0	27.0	23.0	16.0	9.0
RMX 24–D	16.8–26.4	18.0	18.0	16.0	11.0	6.0
RMX 28–D	19.6–30.8	15.4	15.4	13.7	9.4	5.1
RMX 05–N	3.5–5.5	54.0	49.5	45.0	31.5	15.0
RMX 09–N	6.3–9.9	30.0	27.5	25.0	17.5	8.7
RMX 12–N	8.4–13.2	22.8	20.9	19.0	13.3	6.6
RMX 15–N	10.5–16.5	18.0	16.5	15.0	10.5	5.2
RMX 24–N	16.8–26.4	11.4	10.4	9.5	6.6	3.3
RMX 28–N	19.6–30.8	9.6	8.8	8.0	5.6	2.8

TABLE 1-1 D-C OUTPUT RATINGS, RMX–D AND RMX–N GROUPS.

PARAMETER	Typ.	Max.
SOURCE EFFECT (min–max):	< 0.3%	0.6%
LOAD EFFECT (min–max):	< 0.3%	0.6%
TEMPERATURE EFFECT Coefficient per °C:	< 0.02%	0.1%
Envelope 0–50°C:	< 0.4%	0.8%
COMBINED EFFECT: (For rated changes in source voltage, load current and temperature:	< 1.0%	2.0%
TIME EFFECT (8-hour drift) Constant source voltage, load and temperature:	< 0.02%	0.1%
RIPPLE and NOISE Rms:	< 5 mV	10 mV
Source component:	< 10 mV	50 mV
Switching component:	< 15 mV	50 mV
Spike voltage to 10 MHZ:	< 50 mV	1% E_o +50 mV

TABLE 1-2 STABILIZATION AND RIPPLE, RMX–D AND RMX–N.

D) OUTPUT EFFECTS: See Table 1-2.

E) EFFICIENCY: 80% typ., 75% minimum.

F) STORAGE TEMPERATURE: (−)25°C to (+)75°C.

G) TRANSIENT RECOVERY: A step-load change of 50 to 100% produces less than 2% or 0.5 volts, whichever is greater, output voltage excursion and recovers to within 0.5% (or 0.05 volts, whichever is greater) of the original output voltage setting in less than 1 millisecond.

H) HOLDING TIME (CARRY-OVER): Full load output is sustained within the load effect band for a minimum of 20 milliseconds, following loss of a-c input source power. ***NOTE:*** *Specification is based on operation on 115V or 230V a-c source voltage and the 50°C* loading level per Table 1-1.

1-9 MISCELLANEOUS FEATURES:

A) SOFT-START: Soft-start circuit provided on all models, to limit a-c line surge current at the initial turn-on.

B) REMOTE ON/OFF CONTROL. Following initial source turn-on, all RMX models may be turned on and off by means of a TTL logic level (turn-on = high (2-5V), turn-off = low (0-0.4V, I_{sink} = 5 mA max.). The logic level is normally set high (RMX "on") by means of a pull-up resistor. Separate rear-terminals are provided for this function.

C) PROTECTIVE FEATURES:

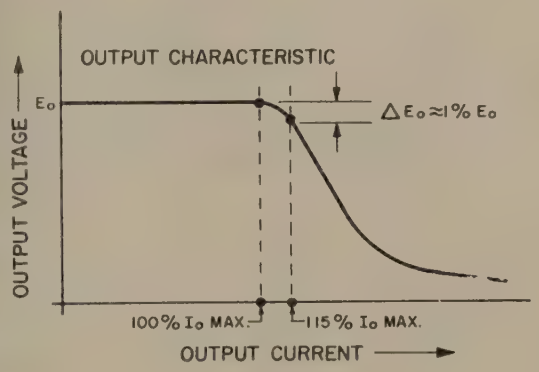
1) A-C INPUT PROTECTION: An a-c line fuse is located on the rear of all RMX models. See Section II, Table 2-1 for fuse values.

2) DRIVER INHIBIT: Turns-off driver circuit when source input fails, or if an overvoltage occurs.

3) OVERVOLTAGE PROTECTION: Turns-off oscillator circuit and reduces power supply output to zero. Reset by turning source power "off" (for approx. 40 seconds to allow input filter to discharge) and then "on" again. Screwdriver adjustable from 1.5 to 3 volts above nominal output voltage.

4) CURRENT LIMIT: (See Output Characteristic Curve)

A current limit circuit is provided which protects the power supply against excessive output current, including short-circuits. Its operation is automatic, that is, the output voltage returns to its previous level once the overcurrent condition is removed. The current limit value is factory-set for each model to 115% of the 50°C output current value per Table 1-1. It can be re-set to 115% of the listed 30°C and 40°C output current values in Table 1-1. The current limit value (115% $I_{o\,max.}$) is defined as the output current value reached when the output terminal voltage (E_o) has dropped approximately 1%, from its initially set value ($\Delta E_o \approx 1\%\ E_o$). The output current value reached when the output voltage approaches zero, may be from 30% to 100% greater than the current limit value, due to component tolerances.



D) OUTPUT VOLTAGE ADJUSTMENT: Output voltage is screwdriver adjustable −30 to +10% around the nominal rated value (see Table 1-1).

E) ELECTROMAGNETIC INTERFERENCE (E.M.I.): Filters are built-in to reduce the conducted EMI (harmonics of the 20 KHz switching frequency) to levels that are acceptable for most applications. An accessory filter, Kepco Model FLA 250-9 (for 115V a-c), or Kepco Model FLA 250-4 (for 230V a-c) may be used between RMX and the source power line to reduce the harmonics at least 40dB in the frequency range from 0.7 to 30 MHz.

F) SHOCK: 20G, 3 axes, 11 ms. ± 5 ms. (Pulse Duration)
VIBRATION: 5-10Hz, 10 mm amplitude, 3 axes, 10-55 Hz: 2G, 3 axes.

G) WITHSTAND VOLTAGE, between input and output terminals or case: 2.5kV a-c for 1 minute.

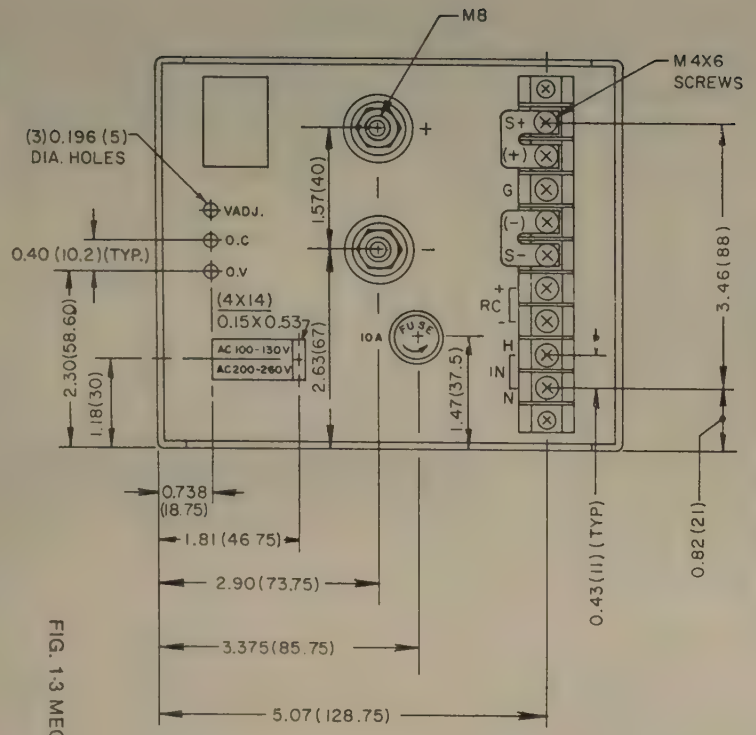
H) ISOLATION, between output terminals and case: 500V d-c, 100 megohms minimum.

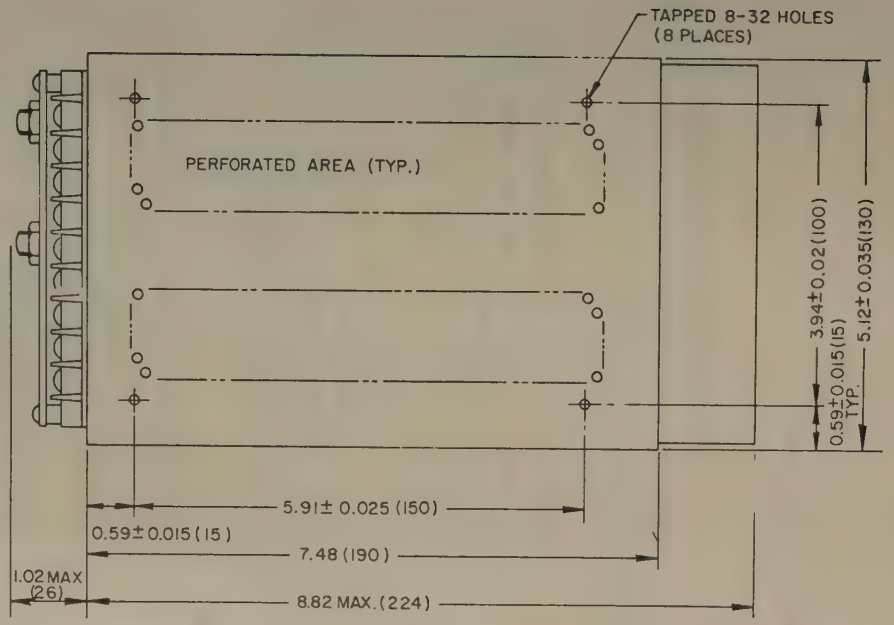
I) SERIES/PARALLEL: RMX power supplies may be connected in series for greater voltage output (up to 500V maximum) and in parallel, for increased current output (see Section III).

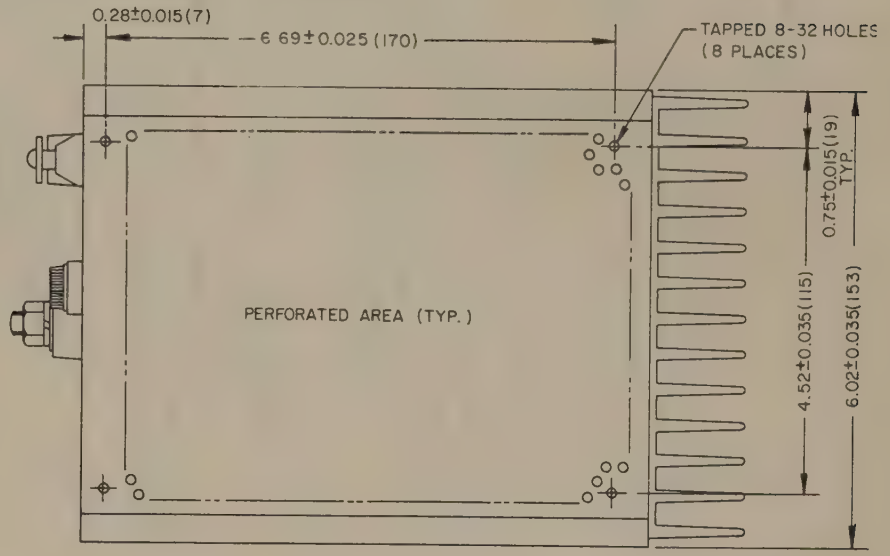
1-10 MECHANICAL SPECIFICATIONS:

A) DIMENSIONS AND FINISH: Refer to FIG. 1-2 "Mechanical Outline Drawing".

B) WEIGHT: RMX-N Group: 8.4 Lbs. (3.8 kg.); RMX-D Group: 9.3 Lbs. (4.2 kg.)







NOTES:

1. THIS DRAWING IS USED FOR MODELS; RMX 05-D, RMX 09-D, RMX 12-D, RMX 15-D, RMX 24-D AND RMX 28-D.
2. MATERIAL: COVERS 1/16 THICK ALUMINUM.
3. FINISH: PHOSPHATE TREATED ALUMINUM.
4. TOLERANCE: ALL DIMENSIONS ±1/32 (±0.8) EXCEPT AS NOTED.
5. DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS.

FIG. 1-3 MECHANICAL OUTLINE DRAWINGS, RMX-D SERIES.

SECTION II – INSTALLATION

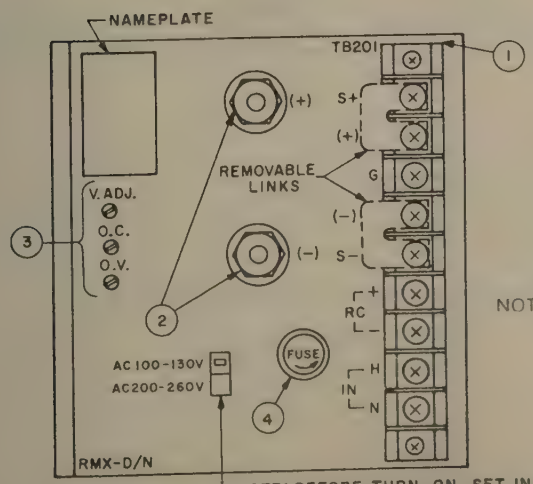
2-1 UNPACKING AND INSPECTION

2-2 This instrument has been thoroughly inspected and tested prior to packing and is ready for operation. Perform the preliminary operational check as outlined in paragraph 2-8. If any indication of damage is found, file an immediate claim with the responsible transport service.

2-3 TERMINATIONS: See FIG. 2-1 and Table 2-1.

NO.	TERMINATION	FUNCTION
1	9-TERMINAL BARRIER STRIP CAUTION Do Not Connect the Load to the (±) Output Monitor Terminals	–, +, = D-C OUTPUT MONITOR TERMINAL S+, S- = SENSING TERMINALS G = CHASSIS CONNECTION: Return to A-C GROUND! +, RC, – = REMOTE TURN-ON/TURN-OFF TERMINALS INPUT H/N = A-C or D-C INPUT TERMINALS
2	HEAVY-DUTY SCREW-TERMINALS	–, +, D-C OUTPUT TERMINALS, LOAD CONNECTION
3	INTERNAL CONTROLS (RECESSED, SCREWDRIVER ADJUSTABLE)	V.ADJ. = OUTPUT VOLTAGE ADJUSTMENT O.C. = CURRENT LIMIT ADJUSTMENT O.V. = OVERVOLTAGE ADJUSTMENT
4	FUSE	10A-250V, SLOW-ACTING, SUCH AS BUSSMAN MDA TYPE, OR EQUIVALENT.

TABLE 2-1 TERMINATIONS, KEPCO RMX POWER SUPPLIES.



NOTE ON ALL RMX UNITS, D-C INPUT VOLTAGE MAY BE APPLIED TO INPUT TERMINALS "H" AND "N" WITHOUT REGARD TO POLARITY. SET SOURCE SELECTOR TO THE "A-C 200–260V" POSITION

FIG. 2-1 TERMINATIONS, KEPCO RMX GROUPS D and N POWER SUPPLIES.

RMX D/N–2278A

2-4 SOURCE POWER REQUIREMENTS

1) A-C INPUT VOLTAGE: 115V ± 15V a-c or 230V ± 30V a-c, D-C INPUT VOLTAGE: 260 to 340V.

2) A-C INPUT FREQUENCY: 47 to 440 Hz, single phase.

3) A-C INPUT CURRENT: Refer to Section I, par. 1-8A.

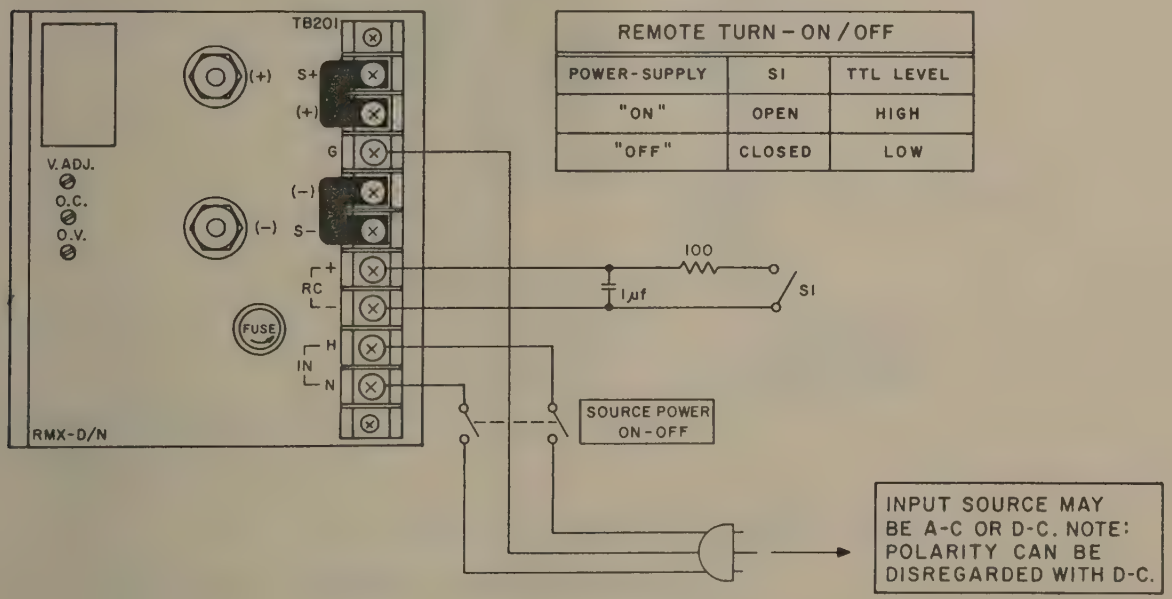
2-5 SOURCE POWER TURN-ON/TURN-OFF

2-6 Source input power to the power supply is applied in the conventional manner by means of an external power switch in series with one or both of the source input terminals, (see FIG. 2-2).

2-7 Following source turn-on, for systems applications, the power supply can be remotely programmed "on" and "off" by means of a contact closure, or TTL logic levels. This permits turn-on/turn-off sequencing and avoids a-c surge currents associated with conventional a-c power turn-on/off cycles. In FIG. 2-2, both, the conventional and the remote a-c power turn-on/turn-off methods are shown.

A) If remote turn-on/off is not needed, delete components connected to terminals +RC, -RC and leave these terminals open.

B) If the remote control method is used, retain the SOURCE POWER switch. NOTE: Source power turn-on/turn-off must be retained since the overvoltage protector circuit must be re-activated, following an overvoltage condition, by removing (approx. 40 seconds) and re-applying the power. Either the indicated switch (S1) or TTL levels may be used for remote "on/off" as indicated in the Table of FIG. 2-2. The switch (S1) must be "chatter-free", *or* the indicated components should be used to integrate the switching pulse.



REMOTE TURN-ON/OFF		
POWER-SUPPLY	S1	TTL LEVEL
"ON"	OPEN	HIGH
"OFF"	CLOSED	LOW

FIG. 2-2 CONVENTIONAL AND REMOTE SOURCE POWER TURN-ON/TURN-OFF.

Note. Remote turn-on/off circuit may be deleted.

2-8 PRELIMINARY CHECK-OUT

2-9 A simple operating check after unpacking and before permanent installation is advisable to ascertain whether the power supply has suffered damage resulting from shipment. Refer to FIG. 2-3 for the location of the output terminals. Connect output metering and load as shown.

a) Connect power supply to 115V a-c source. Use either turn-on/turn-off method as described in PAR. 2-5 through 2-7.

b) Turn the RMX power supply "on" and observe the output voltage meters (M1, M2) for the rated nominal output voltage and current of the RMX model under test.

c) Check the current limit point by ***reducing*** the load resistance until the output voltage starts to decrease, as observed on M1. The output current value, as observed on M2, should be approximately 110% of the rated nominal output current value for the RMX power supply under test. This concludes the preliminary check-out.

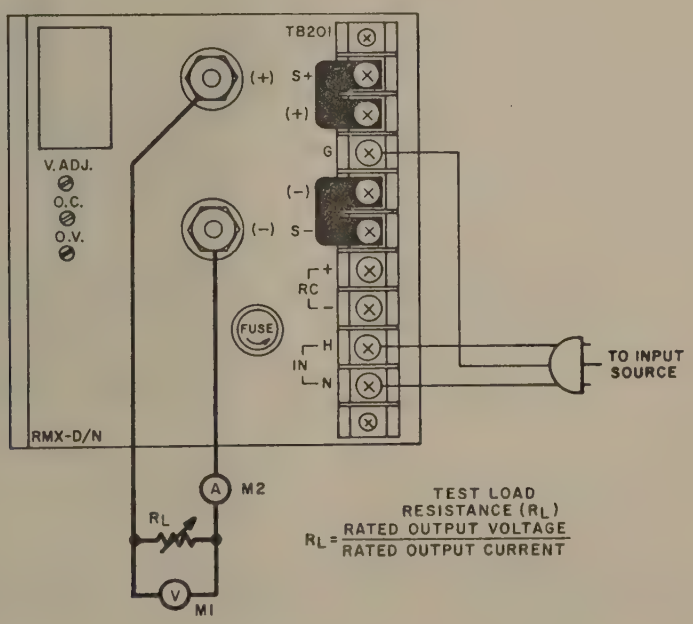


FIG. 2-3 CONNECTIONS FOR THE PRELIMINARY CHECK-OUT.

2-10 INSTALLATION AND COOLING REQUIREMENTS

2-11 GENERAL. RMX power supplies may be operated in ambient temperatures from 0 to 71°C, without forced air cooling and with the output current as listed in Section I, Table 1-1, when mounted as described in the following paragraphs.

2-12 MOUNTING WITHOUT FORCED-AIR COOLING. FIG. 2-4 below shows the recommended mounting method for RMX–D and RMX–N power supplies mounted without forced-air cooling.

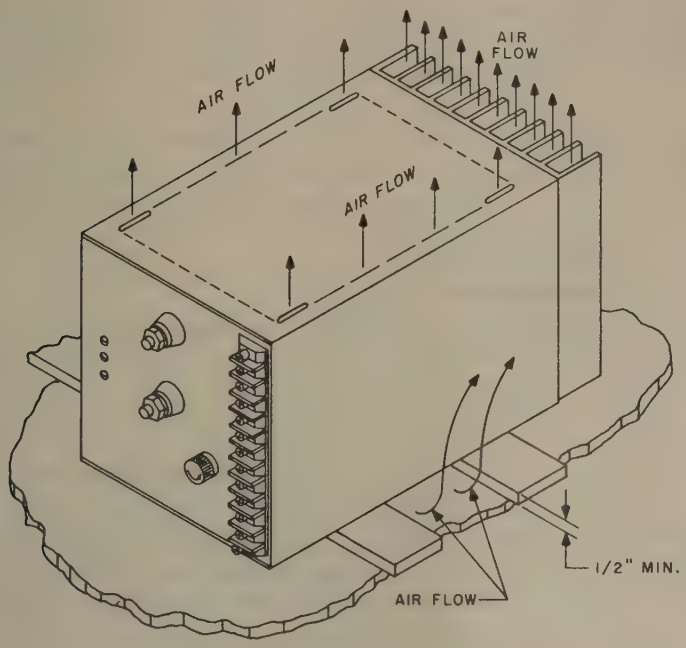


FIG. 2-4 RECOMMENDED MOUNTING METHOD (VERTICAL) FOR RMX GROUP D and RMX GROUP N POWER SUPPLIES (CONVECTION COOLING), WITH STANDARD HEAT SINK.

Output current rating:
Determine ambient temperature and use Table 1-1, Section I.

CAUTION

ALL POWER SUPPLY OUTPUT CURRENT RATINGS ARE BOUND BY A MAXIMUM AVERAGE HEAT SINK TEMPERATURE OF 80°C AND BY THE MAXIMUM OUTPUT CURRENT OF EACH MODEL, AS LISTED IN THE 30°C COLUMN OF TABLE 1-1, SECTION I.

IF A RELIABLE MEANS OF DETERMINING THE HEAT SINK TEMPERATURE IS AVAILABLE, POWER SUPPLIES MAY BE MOUNTED IN ANY POSITION AND MAY BE OPERATED AT THEIR MAXIMUM CURRENT (AS LISTED IN THE 30° COLUMN OF TABLE 1-1, SECTION I) AS LONG AS THE MEASURED AVERAGE HEAT SINK TEMPERATURE DOES NOT EXCEED 80°C. IF NECESSARY, FORCED AIR FLOW CAN BE PROVIDED TO KEEP THE HEAT SINK TEMPERATURE AT OR BELOW 80°C. FOR ADDITIONAL PROTECTION, A THERMALLY ACTUATED SWITCH CAN BE MOUNTED ONTO THE HEAT SINK, WITH ITS "NORMALLY OPEN" CONTACTS WIRED ACROSS THE POWER SUPPLY'S "RC" TERMINALS. IN THE EVENT OF AN OVER-TEMPERATURE CONDITION, THE "RC" TERMINALS WILL BE SHORTED AND THEREBY INHIBIT ALL OUTPUT FROM THE POWER SUPPLY, AS LONG AS THE OVER-TEMPERATURE CONDITION PERSISTS.

SECTION III – OPERATION

3-1 GENERAL

3-2 Interconnection between the a-c power source and a stabilized power supply, and between the power supply and its load are as critical as the interface between any other electronic equipment. If optimum performance is expected, certain rules for the interconnection of source, power supply and load must be observed by the user. These rules are described in detail in the following paragraphs.

3-3 SAFETY GROUNDING

3-4 National and international safety rules dictate the grounding of the metal cover and case of any instrument connected to the a-c power source.

WARNING

KEEP INSTRUMENT GROUNDED WHILE IT IS CONNECTED TO THE A-C POWER SOURCE

3-5 The recommended a-c power connections to RMX power supplies by means of a three-wire a-c line cord with grounding plug are illustrated in all diagrams in this section (Section III).

3-6 SIGNAL GROUNDING

3-7 Connections between the power supply and the load (load and sensing connections), will invariable, despite all precautions such as shielding, twisting of wire-pairs, etc., "pick-up" radiated noise of a wide frequency spectrum. To minimize this undesired output, a SIGNAL GROUND is needed. The signal ground consists of a single ground point, either at one of the power supply output terminals or at one side of the load.

3-8 Kepco has provided an internal signal ground on all models in the RMX series, consisting of a capacitor from both d-c output terminals to the chassis. If, therefore, the chassis of the RMX is a-c safety grounded by means of its three-prong plug, the safety, as well as the signal ground is automatically established.

3-9 The signal ground provided internally in the RMX is sufficient for performance within specifications for most applications with an isolated load. If the load has its own ground, however, or high ripple is observed during operation, an additional filter capacitor may be requied directly across the load terminals.

3-10 POWER SUPPLY/LOAD INTERFACE

3-11 The general function of a voltage or current stabilized power supply is to deliver the rated output quantities to the connected load. The load (or loads) may have any conceivable characteristic. It may be fixed or variable, it may have predominantly resistive, capacitive, or inductive parameters, and it may be located very close to the power supply, or it may be a considerable distance away. The power supply designer cannot anticipate every conceivable application, location or nature of the load. He must design his product for the widest possible application range and specify the performance at the output terminals of the power supply. The aim of the following paragraphs is to aid the user in the final use of the product, the interface of the power supply and the load.

3-12 The perfect interface between a power source and its load would mean that the specified performance at the output terminals would be transferred without impairment to any load, regardless of its characteristics, distance from the power supply or environment. To approach this ideal, the power supply must satisfy certain requirements. Interconnecting rules must be closely followed and Ohm's Law, as well as basic a-c theory must be considered in selecting the interface wiring.

3-13 The stabilized d-c power supply is definitely not an ideal voltage or current source with zero output impedance (VOLTAGE MODE) at all fequencies. All voltage sources have some amount of impedance which increases with frequency. (Refer to FIG. 3-1). A more realistic model for a voltage stabilized power supply must, for example, include a series resistance, representing the small d-c and low frequency source impedance, in series with an inductance, representing the source impedance at higher frequencies.

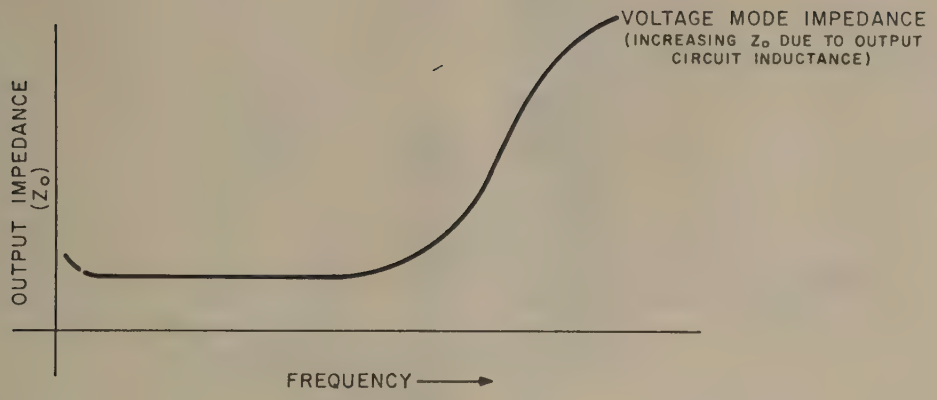


FIG. 3-1 TYPICAL OUTPUT IMPEDANCE VS. FREQUENCY PLOT FOR STABILIZED D-C VOLTAGE SOURCES.

3-14 LOAD WIRE SELECTION

3-15 Load wire selection should proceed considering the facts discussed in PAR's 3-10 to 3-14. The load wire size should be selected for minimum voltage drop, and the series inductance of the load wire must be kept as small as possible compared to the output impedance of the power supply. These considerations are especially important if:

1) The load is constantly changing in value.

2) The load is switched "on" and "off"

3) The load has a primarily reactive characteristic.

4) The dynamic output response of the power supply is considered important.

IN PRACTICAL TERMS, THE LOAD WIRE SHOULD ALWAYS BE AS HEAVY AND AS SHORT AS POSSIBLE.

In spite of all precautions taken in interconnecting the power supply and the load, and in spite of the low ESR electrolytics and high frequency bypass capacitors used in the output of the RMX power supply, the power supply/load connection wires may "pick-up" high frequency swiching noise.

An effective solution to the pick-up problem is to locate an external shunt filter directly at the load, as indicated in all connection diagrams in this section. The filter consists of a low/high frequency bypass capacitor (C1 = 50μF electrolytic, C2 = 0.1μF film, working voltages according to power supply output voltage). The given values have been used successfully for most applications.

3-16 LOAD CONNECTIONS

3-17 The load may be connected in one of the ways illustrated in FIG's 3-2 and 3-3. IMPORTANT NOTE: IF ERROR SENSING IS USED, THE SHORTING LINKS BETWEEN OUTPUT AND SENSING TERMINALS MUST BE COMPLETELY REMOVED. IF ERROR SENSING IS NOT USED, THE LINKS MUST BE CONNECTED AT THE BARRIER STRIP. TIGHTEN BARRIER STRIP TERMINAL SCREWS SECURELY. LOOSE CONNECTIONS MAY CAUSE MALFUNCTIONING OF THE POWER SUPPLY.

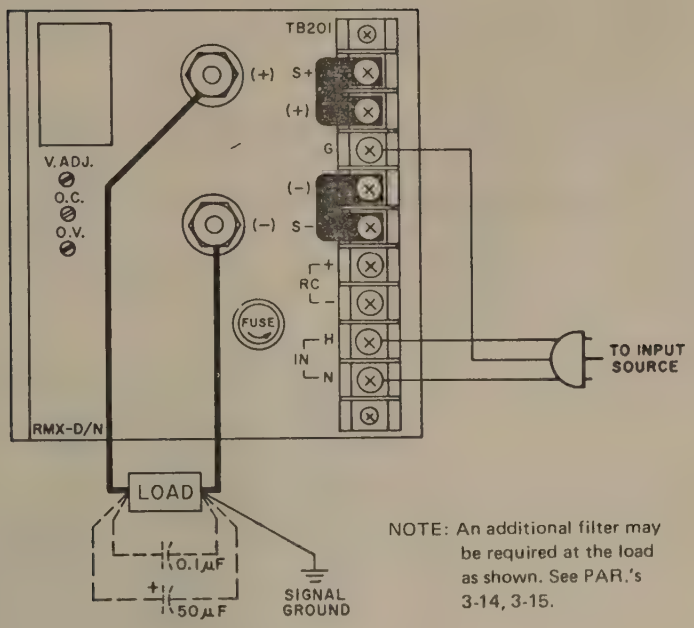


FIG. 3-2 LOAD CONNECTIONS WITHOUT ERROR SENSING.

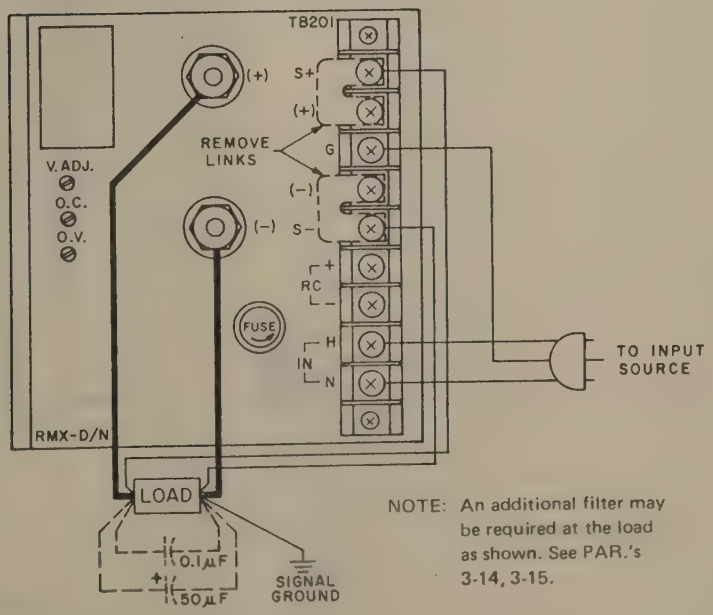


FIG. 3-3 LOAD CONNECTIONS WITH ERROR SENSING.

3-18 SERIES OPERATION OF RMX POWER SUPPLIES

3-19 KEPCO RMX power supplies can be series connected for increased output voltage, provided the specified limits on voltage to chassis are not exceeded.

3-20 PROCEDURE (Refer to FIG. 3-4):

STEP 1) Connect supplies and load as shown in FIG. 3-4. Keep voltage drop in load wires as low as possible by using proper gauge wire.

STEP 2) Remove jumpers as shown and connect error sensing leads to load. Use at least #20 gauge wire for error sensing leads. Twist all lead pairs.

STEP 3) Turn supplies "on" and adjust output on either one or both voltage controls as required.

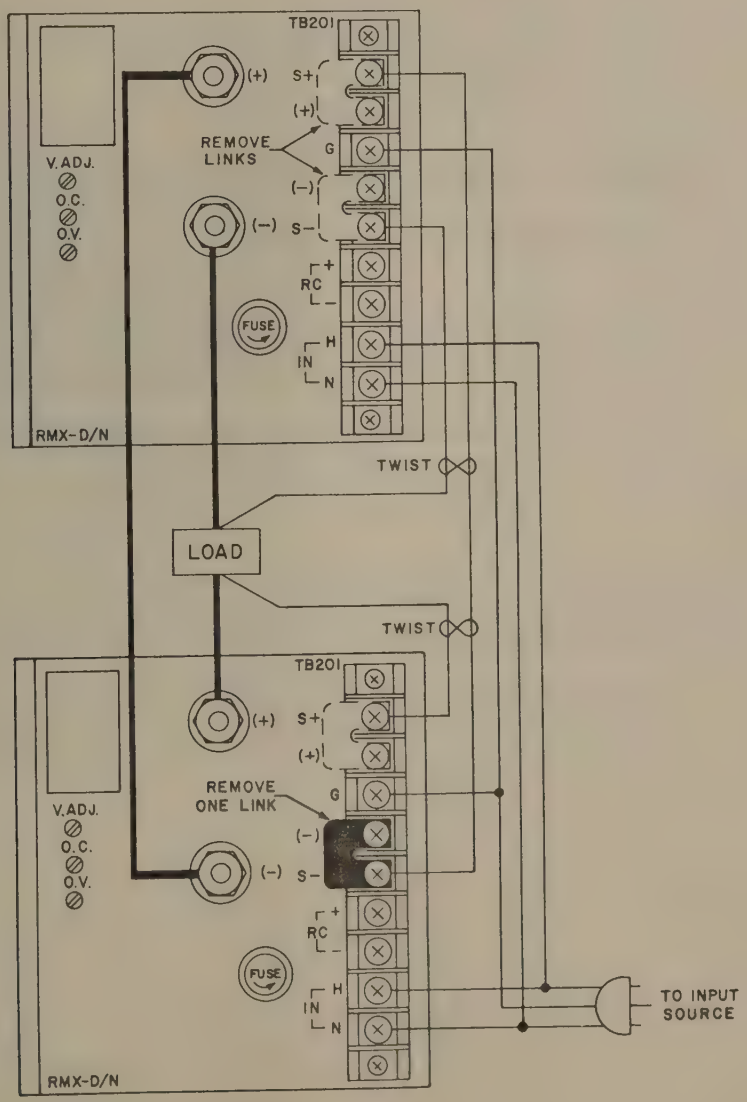


FIG. 3-4 SERIES CONNECTION OF TWO POWER SUPPLIES, WITH ERROR SENSING AT THE LOAD.

3-21 PARALLEL OPERATION OF RMX POWER SUPPLIES

3-22 When two RMX power supplies operate into a load demanding more output current than one of them can deliver, one of them will always be at a slightly higher output voltage level than the other, in spite of any attempt to equalize the output voltages before connecting the load. The supply with the higher output voltage (Supply #1) will therefore attempt to deliver all the output current, but will only be able to supply current up to its current limit setting and will then transfer into the current limit mode. The other supply (Supply #2) will now take over and deliver the balance of the output current, while operating in the voltage mode.

NOTE: The following example describes the parallel operation of two (2) Model RMX 05–D, for a total output current of 120 amperes, with an operating voltage of 5 volts at the load and a total load wire voltage drop of 0.4 volts. The expected ambient temperature is 40°C.

A) LOAD POWER REQUIRED: 5V x 120 A = 600 WATT

B) LOAD WIRE POWER LOSS: 0.4V x 120 A = 48 WATT

TOTAL POWER = 648 WATT

C) ONE RMX 05–D MUST SUPPLY: 648/2 = 324 WATT AT 40°C.

D) A CHECK WITH THE RATING TABLE (SECTION I, TABLE 1-1) SHOWS THAT THIS IS WITHIN THE SAFE OPERATING REGION OF THE RMX 05–D (TABLE VALUE = 5V x 70A = 350W @ 40°C).

3-23 PROCEDURE, PARALLEL CONNECTION OF TWO RMX POWER SUPPLIES

Set operating controls on ***each*** RMX as follows:

1) V.ADJ. control: 5.1 Volt.
2) O.C. control: Leave at factory setting (66A = 110% of rated current).
3) O.V. control: Turn maximum clockwise.

STEP 1) Connect RMX power supplies, instrumentation and load, as shown in FIG. 3-5.

STEP 2) Turn power supply system "on" and monitor load voltage and current as indicated in FIG. 3-5.

STEP 3) With a suitable screwdriver, slowly turn V.ADJ. control of Supply #1 counterclockwise until 5.00 volts is read out on M1.

STEP 4) Turn V.ADJ. of Supply #2 slowly counterclockwise until it takes control from Supply #1, as indicated by the changing voltmeter reading on M1. Turn V.ADJ. to approximately 4.90 volts and then slowly approach 5.00 volts until Supply #2 just reaches 5.00 volts. This concludes the adjustment.

Note: Careful adjustment of the output voltage of the two supplies will result in equal current sharing and yield load effects close to that of a single unit. A carefully adjusted system should yield output voltage changes for full load to no load of approximately 60mV.

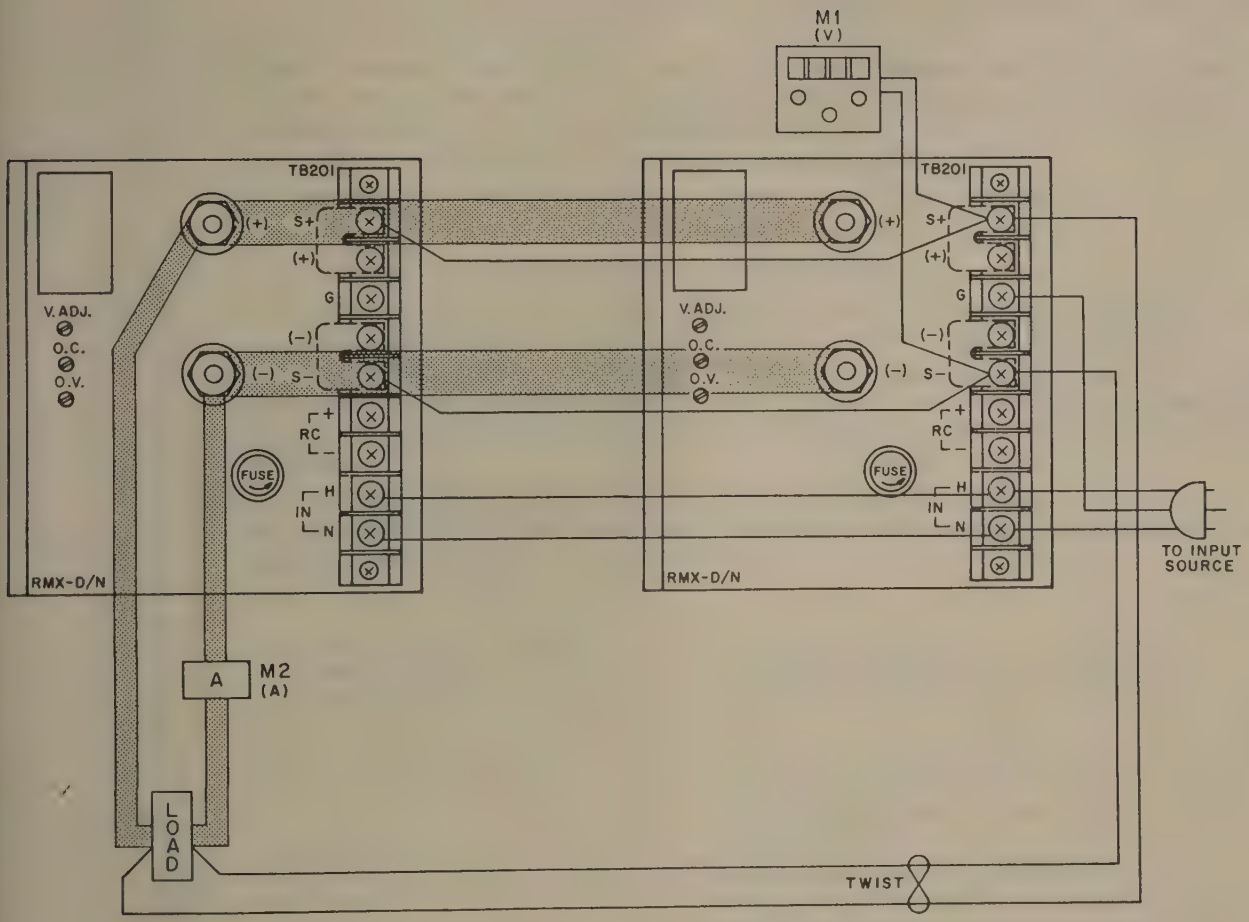


FIG. 3-5 PARALLEL CONNECTION OF TWO POWER SUPPLIES, WITH ERROR SENSING AT THE LOAD.

NOTE: For parallel connections of two or more power supplies, the load leads should be as heavy and as short as possible. It is recommended, that short, heavy bus-bars are used and that the supplies are kept physically close together, as indicated in FIG. 3-5.

3-24 MULTIPLE PARALLEL CONNECTION OF RMX POWER SUPPLIES

3-25 The previously discussed concepts for paralleling RMX modules (Paragraphs 3-21 through 3-23) can be extended to include more than two power supplies, the practical limit being dictated by the larger load wire size required. The following parameters must be determined before each system's application involving multiple parallel connection of RMX Power Supplies:

1) REQUIRED LOAD VOLTAGE AND CURRENT
2) ANTICIPATED MAXIMUM AMBIENT TEMPERATURE
3) LOAD WIRE VOLTAGE DROP FROM THE POWER SUPPLIES TO THE LOAD MUST NOT EXCEED 0.25 VOLT PER LEAD (0.5V TOTAL).

3-26 The following example described the parallel operation of three (3) Model RMX 05-D, for a total load wire drop of 0.5 volt. The anticipated maximum ambient temperature is 40 °C. A short calculation will reveal whether these parameters are within the capabilities of the proposed system:

A) LOAD POWER REQUIRED: 5V x 180A = 900 WATT

B) LOAD WIRE POWER LOSSES: 0.5V x 180A = 90 WATT

Total = 990 WATT

C) ONE RMX 05-D MUST SUPPLY 990/3 = 330 WATT at 40 °C.

D) A CHECK WITH THE RATING TABLE (SECTION I, TABLE 1-1) SHOWS THAT THIS IS WITHIN THE SAFE OPERATING REGION OF THE RMX MODEL (TABLE VALUE: 5V x 70A = 350W @ 40 °C).

3-27 The power supplies are rack-mounted as shown in FIG. 3-6 and are, therefore, physically close together. To inter-connect the output terminals and the load, heavy copper bus-bars are used to keep the voltage drops to a minimum. Wire gage for the error sensing leads and the input source wiring are noted in the set-up diagram (FIG. 3-6).

3-28 PROCEDURE, MULTIPLE PARALLEL CONNECTION OF RMX POWER SUPPLIES

NOTE: Before connecting the RMX supplies to the parallel set-up, turn supplies "on" individually and set their operating controls as follows:

RMX CONTROL	CONTROL-SETTING (ALL SUPPLIES)
V.ADJ	5.1 VOLTS
O.C.	66A (110% OF RATED CURRENT. THIS IS THE STANDARD FACTORY SETTING).
O.V.	MAXIMUM CLOCKWISE = APPROX. 6V. THIS SETTING WILL STILL PROVIDE OVERVOLTAGE PROTECTION AND AT THE SAME TIME PREVENT FALSE TRIGGERING OF THE OVERVOLTAGE PROTECTOR.

STEP 1) Connect RMX supplies as shown in FIG. 3-6.

NOTE: Leave the (+) bus from Supply #2 to the load open and connect an accurate d-c ammeter of suitable range between the (+) bus and the load (M2 in FIG. 3-6). Monitor output voltage with a digital voltmeter (M1 in FIG. 3-6).

STEP 2) Turn power supply system "on" and monitor load voltage and current as indicated in FIG. 3-6.

STEP 3) With a suitable screwdriver, slowly turn V.ADJ control of Supply #1 counterclockwise until 5.00 volts is read out on M1.

STEP 4) Turn V.ADJ of Supply #2 slowly counterclockwise until it takes control from Supply #1 as indicated by the voltmeter reading on M1. Turn V.ADJ to approximately 4.90 volts and then slowly approach 5.00 volts until Supply #2 just reaches 5.00 volts.

STEP 5) Repeat the process described in Step #4 for Supply #3 until all supplies are operating close to the required load voltage. This concludes the adjustment.

Note: Careful adjustment of the output voltage of all supplies will result in equal current sharing and yield load effects close to that of a single unit. A carefully adjusted system should yield output voltage changes for full load to no load of approximately 60mV.

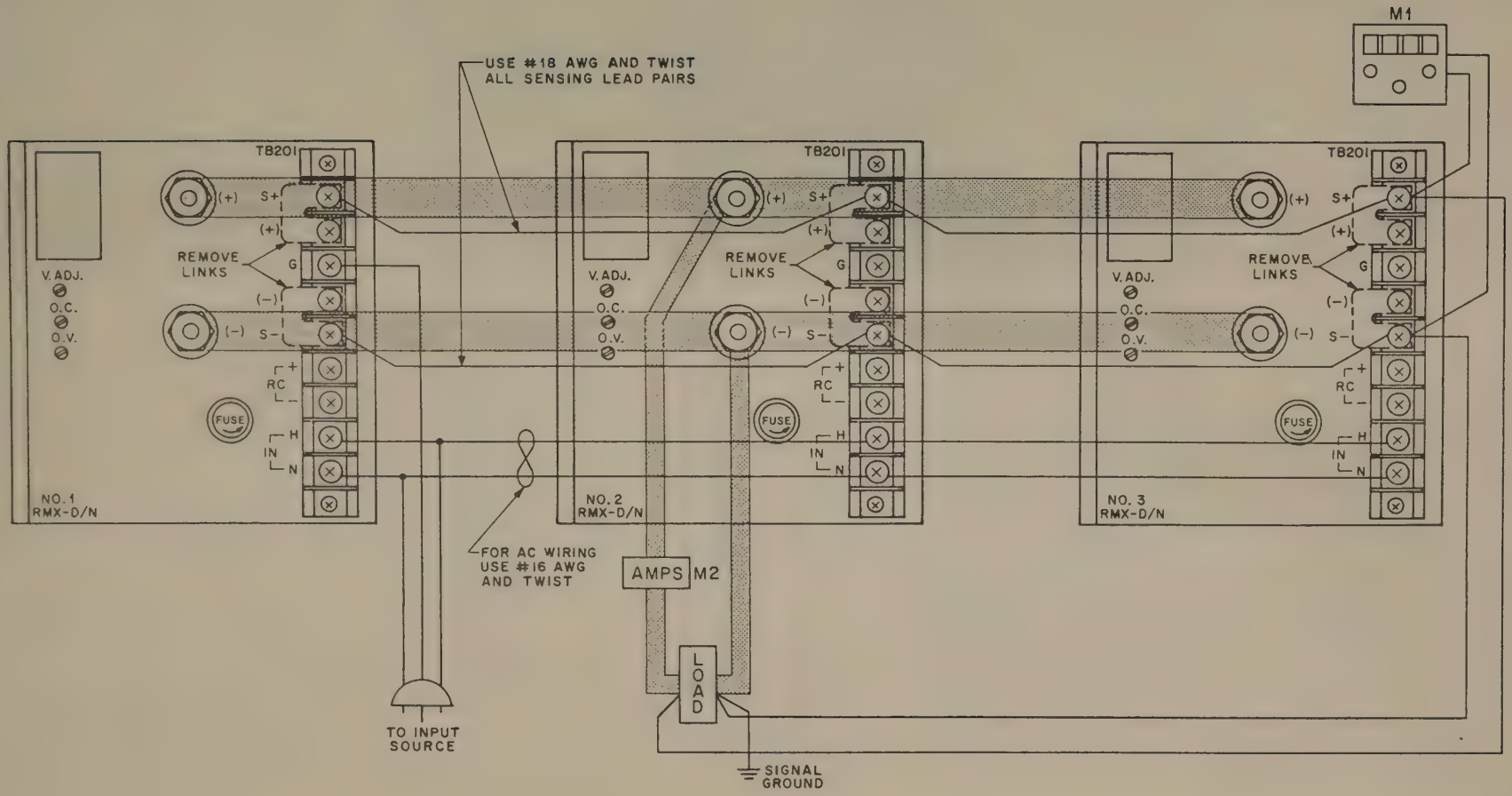


FIG. 3-6 THREE (3) POWER SUPPLIES CONNECTED IN PARALLEL, WITH ERROR SENSING AT THE COMMON LOAD.

3-29 INTERNAL CONTROLS OF THE RMX POWER SUPPLY

3-30 Three recessed, screwdriver adjustable controls have ben provided on the RMX power supply. They are located to the side of the barrier strip and are clearly marked on each RMX model as follows; (Refer to FIG. 3-5, for example):

V.ADJ = Output Voltage Adjustment
O.C. = Current Limit Point Calibration
O.V. = Overvoltage Limit Point Calibration

3-31 The voltage controls of each RMX model are factory set to the nominal values, given in Section I, Table 1-1. The "V.ADJ" (OUTPUT VOLTAGE ADJUSTMENT) may be set to any value within the given output voltage range. The "OV" adjustment can be set approximately ±5% around the overvoltage limit point (120% of the nominal output voltage), thus either increasing or decreasing the threshold of the overvoltage protector. The output current limit contro (O.C.) on each RMX model is set to approximately 110% of the 50°C rating. It may be reset to the higher output current values, as listed in the 40°C and 30°C columns of Table 1-1 by following the procedure given in PAR. 3-34.

NOTE: To reset any control, the locking paint around the control slot must first be carefully removed by means of a needle, or other pointed instrument. DO NOT RESET ANY CONTROL BEYOND THE VALUES GIVEN IN SECTION I, TABLE 1-1. ALTHOUGH THIS MAY BE POSSIBLE (DUE TO COMPONET TOLERANCES), POWER SUPPLY DAMAGE MAY RESULT. Instructions for setting the current limit and the overvoltage limit point are given in PAR. 3-34 and PAR. 3-35 respectively.

3-32 Re-adjustment of all internal controls is described in the following paragraphs.

CAUTION

RE-SETTING THE VOLTAGE ADJUSTMENT (V.ADJ.) OR THE CURRENT LIMIT (O.C.) TO *HIGHER* VALUES REQUIRES CAREFUL CONSIDERATION OF THE RATING TABLE, SECTION I, TABLE 1-1. OPERATION OF THE RMX BEYOND THE PARAMETERS GIVEN IN THE RATING TABLE MAY DAMAGE THE RMX POWER SUPPLY.

3-33 OUTPUT VOLTAGE ADJUSTMENT **(V.ADJ)**

A) Monitoring the RMX output voltage at the output terminal with an accurate voltmeter, (M1 in FIG. 3-7, set the "V.ADJ" control to the desired value. (Refer to FIG. 3-7).

B) Multiply the adjusted output voltage value by the load current value to compute the output power. Multiply the voltage drop along the load wire (both sides) with the load current value and add this power loss to the output power. Consult the RATING TABLE (SECTION I, TABLE 1-1) and check if the computed output power plus the power loss, and the anticipated temperature permit operation within the values listed in the table (see the sample calculations, par. 3-22, 3-26).

3-34 CURRENT LIMIT ADJUSTMENT (O.C.)

A) Set-up the test circuit shown in FIG. 3-7. Turn "O.C." control to its maximum **clockwise** position. Turn a-c power "on". Set ADJUSTABLE LOAD to draw the desired load current, plus approximately 15%, as read-out on M2.

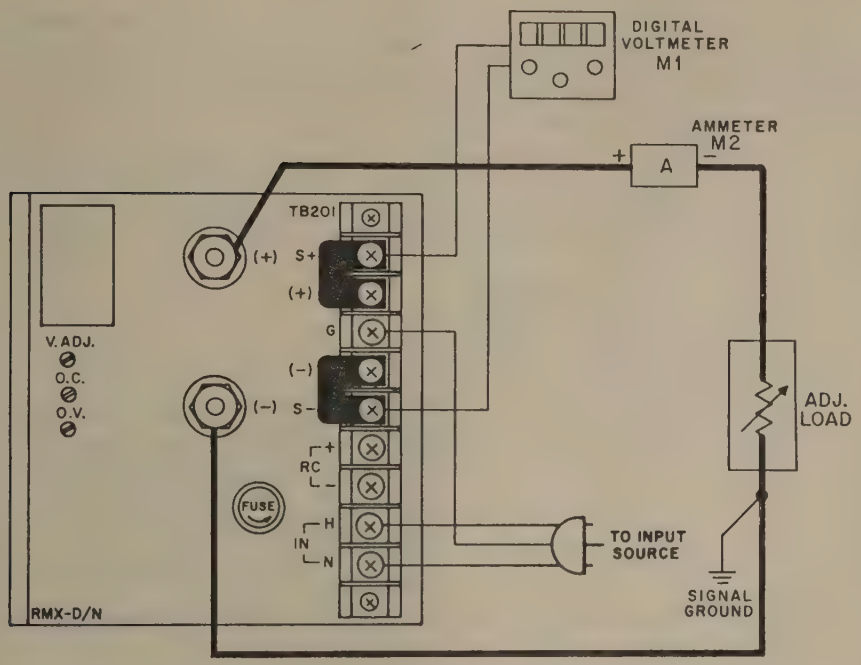


FIG. 3-7 TEST SET-UP FOR ALL INTERNAL CONTROL ADJUSTMENTS.

B) Turn "O.C." Control slowly **counterclockwise** until the output voltage, as read-out on M1, starts to decrease. Slightly back-off the"O.C." control in the **clockwise** direction.

C) Check the current limit point by adjusting the load from its maximum resistance (minimum current) toward a value yielding the required operating current. Decrease the load resistance further, monitoring M1 and M2. The output voltage should start to decrease at the adjusted current limit point, approximately 15% beyond the desired operating current.

3-35 OVERVOLTAGE ADJUSTMENT (O.V.)

A) Use the test set-up shown in FIG. 3-7.

B) Turn the O.V. Control to its maximum **clockwise** position. Turn a-c power "on" and adjust the VOLTAGE CONTROL ADJUSTMENT (V. ADJ.) to the desired **overvoltage limit point, plus the total load wire voltage drop.**

C) Turn O.V. control slowly **counterclockwise,** until the VOLTMETER READING GOES TO ZERO.
NOTE: *Following the shut-down of the power supply by means of the overvoltage protector, the a-c power to the RMX power supply must be interrupted for approximately 40 seconds, to reset the protective circuit.*

D) Reset the V. ADJ. control to the desired **output voltage level.** The smallest possible 'threshold" (difference between **overvoltage adjustment level** and **output voltage level)** is approximately 0.5 volts.

SECTION IV—ELECTRICAL PARTS LIST AND DIAGRAMS

4-1 GENERAL

4-2 This section contains the Main Schematic, the Parts Location Diagrams, and a list of all replaceable electrical parts. All components are listed in alpha-numerical order of their reference designations. Consult your Kepco Respresentative for replacement of parts not listed here.

4-3 ORDERING INFORMATION

4-4 To order a replacement part or to inquire about parts not listed in the Parts List, address your order or questions either to your authorized Kepco Sales Representative or to:

KEPCO INC.
131—38 Sanford Avenue
Flushing, N.Y. 11352

4-5 Specify the following information for each part:

a) Model and complete serial number of instrument.

b) Kepco Part Number.

c) Circuit Reference Designator.

d) Description.

4-6 To order a part not listed in the Parts List, give a complete description and include its function and location.

ABBREVIATIONS USED IN KEPCO PARTS LISTS

A) Reference Designators:

A	= Assembly
B	= Blower (Fan)
C	= Capacitor
CB	= Circuit Breaker
CR	= Diode
DS	= Device, Signaling (Lamp)
F	= Fuse
FX	= Fuse Holder
IC	= Integrated Circuit
J	= Jack
K	= Relay
L	= Inductor
LC	= Light-Coupled Device
M	= Meter
P	= Plug
Q	= Transistor
R	= Resistor
S	= Switch
T	= Transformer
TB	= Terminal Block
V	= Vacuum Tube
X	= Socket

B) Descriptive Abbreviations

A	= Ampere
a-c	= Alternating Current
AMP	= Amplifier
AX	= Axial
CAP	= Capacitor
CER	= Ceramic
CT	= Center-Tap
°C	= Degree Centigrade
d-c	= Direct Current
DPDT	= Double Pole, Double Throw
DPST	= Double Pole, Single Throw
ELECT	= Electrolytic
F	= Farad
FILM	= Polyester Film
FLAM	= Flammable
FP	= Flame-Proof
°F	= Degree Fahrenheit
FXD	= Fixed
Ge	= Germanium
H	= Henry
Hz	= Hertz
IC	= Integrated Circuit
K	= Kilo (10^3)
m	= Milli (10^{-3})
M	= Mega (10^6)
MFR	= Manufacturer
MET	= Metal
n	= Nano (10^{-9})
NC	= Normally Closed
NO	= Normally Open
p	= Pico (10^{-12})
PC	= Printed Circuit
POT	= Potentiometer
PIV	= Peak Inverse Voltage
p-p	= Peak to Peak
ppm	= Parts Per Million
PWR	= Power
RAD	= Radial
RECT	= Rectifier
RECY	= Recovery
REG	= Regulated
RES	= Resistor
RMS	= Root Mean Square
Si	= Silicon
S-End	= Single Ended
SPDT	= Single Pole, Double Throw
SPST	= Single Pole, Single Throw
Stud Mt	= Stud Mounted
TAN	= Tantalum
TSTR	= Transistor
μ	= Micro (μ) (10^{-6})
V	= Volt
W	= Watt
WW	= Wire Wound

KEPCO® REPLACEMENT PARTS LIST

MODEL RMX-D SERIES **COMMON PARTS LIST** **Code 08-1882**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
C2	1	Cap., Film, Ax. Leads 0.022μF, 10%, 600V	Matsushita ECQ-F6223KZ	517-0068	1
C3,15,17,25	4	Cap., Elect., S-End Leads 33 μF, 20%, 16V	Nippon Chemi-Con KX16VB-33	517-0123	1
C4,5,6,7	4	Cap., Elect., Can Type 560μF, −10+50%, 200V	Nippon Chemi-Con BX200LGSN560	517-0148	1
C8,9	2	Cap., Assembly	TDK 3EF7375	517-0224	1
C10,11,24	3	Cap., Metal Film, Rad. Leads 0.33μF, 10%, 250V	Nittuko MD1-2E0.33μF	517-0149	1
C12	1	Cap., Mica, Rad. Leads 470pF, 10%, 500V	Soshin DM15C471K5	517-0071	1
C13	1	Cap., Film, Rad. Leads 0.047μF, 10%. 200V	Matsushita ECQ-M2473KZ	517-0150	1
C14	1	Cap., Film, Rad. Leads 4700pF, 10%, 200V	Matsushita ECQ-M2472KZ	517-0056	1
C16	1	Cap., Elect., S-End Leads 220μF, 20%, 16V	Nippon Chemi-Con KX16VB-220	517-0122	1
C18,19,26,50	4	Cap., Ceramic Disc. 0.047μF, +80−20%, 50V	TDK SC45F1H473Z	517-0107	1
C20,21	2	Cap., Elect., S-End Leads 2.2μF, 20%, 63V	Nippon Chemi-Con KX63VB-2R2	517-0151	1
C22	1	Cap., Film, Rad. Leads 0.01μF, 10%, 400V	Matsushita ECQ-M4103KZ	517-0059	1
C23	1	Cap., Elect., S-End Leads 10μF, 20%, 50V	Nippon Chemi-Con KX50VB-10	517-0142	1
C41	1	Cap., Film, Rad. Leads 0.1μF, 10%, 50V	Matsushita ECQ-M05104KZ	517-0004	1
C42,43,44,45	4	Cap., Metal Film, Rad. Leads 0.047μF, 10%, 630V	Nittuko MD1-2J0.047μF	517-0057	1
C46,47	2	Cap., Film, Rad. Leads 1000pF, 10%, 50V	Matsushita ECQ-M05102KZ	517-0005	1
C48	1	Cap., Film, Rad. Leads 1500pF, 10%, 600V	Matsushita ECQ-M6152KZ	517-0042	1
C49	1	Cap., Film, Rad. Leads 1500pF, 10%, 50V	Matsushita ECQ-M05152KZ	517-0002	1
CR1	1	Rect., Bridge, Block 600V (PIV), 25A	General Instruments KBPC25-06	524-0034	1
CR2	1	Diode, Zener, Ax. Leads 82V, 5%, ½W	NEC RD82EB	521-0075	1
CR4,5	2	Diode, Zener, Ax. Leads 100V, 5%, ½W	NEC RD100EB	521-0076	1
CR6,8,9,10,14, 15,17,18,19, 20,25,38	12	Diode, Switching, Ax. Leads 50V (PIV), ½W	NEC 1S954	524-0008	1
CR7,13	2	Diode, Zener, Ax. Leads 5.6V, 3%, ½W	NEC RD5.6E±3%	521-0004	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC

KEPCO® REPLACEMENT PARTS LIST

MODEL RMX-D SERIES **COMMON PARTS LIST** **Code 08-1882**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
CR11,12,28, 29,30,31	6	Diode, Switching, Ax. Leads 400V (PIV), 1A	NEC 1S2674	524-0013	2
CR16	1	Diode, Zener, Ax. Leads 8.2V, 3%, ½W	NEC RD8.2E ± 3%	521-0009	1
CR23	1	Diode, Zener, Ax. Leads 7.5V, 3%, ½W	NEC RD7.5E ± 3%	521-0020	1
CR24	1	Diode, Zener, Ax. Leads 3.0V, 5%, ½W	NEC RD3.0EB	521-0050	1
CR26,27	2	Diode, Zener, Ax. Leads 36V, 5%, ½W	NEC RD36EB	521-0048	1
CR32,33	2	Diode, Switching, Ax. Leads 600V (PIV), 1A	NEC 1S2676	524-0029	1
CR40	1	Thyristor, Triac, Stud-Mtg. 400V (V_{RAM}), 16A	NEC 16AC5S	524-0035	1
F1	1	Fuse, Medium Acting 10A, 250V	Bussman ABC10	541-0061	5
FX1	1	Fuse Holder	Showa Musen S-N1301	546-0006	1
IC1	1	IC, Pulse-Width Modulator 16 Pin Dip	Texas Instruments SG3524	550-0015	1
L1,2	2	Choke, Filter, Input	TDK LF018UL	500-0331	1
L3	1	Choke, Filter, Dual Input	TDK LF025UL	500-0327	1
L5	1	Choke, Filter, Auxiliary	TDK SP0406-2R7M	500-0150	1
L6	1	Choke, Filter, Auxiliary	TDK SP0406-120K	500-0149	1
Q1,10	2	Transistor, Si., PNP Low Power Amp., 2-5B	Toshiba 2SA562Y	519-0006	1
Q2,4,13,14	4	Transistor, Si., NPN Low Power Amp.	Matsushita 2SC1384R	519-0024	1
Q3	1	Transistor, Si., NPN H.V. Switch, TO-66	Matsushita 2SD470B	519-0019	1
Q5 thru 9, 11,12	7	Transistor, Si., NPN Low Power Driver, 2-5B	Toshiba 2SC735Y	519-0008	1
Q15,16	2	Transistor, Si., NPN High Power Switch, TO-3	Shindengen 2SC2507	519-0037	2
R1	1	Res., Fxd., W.W., F.P. 7.5 ohm, 10%, 7W	Matsushita ERF-7AK7R5B	515-0225	1
R2	1	Res., Fxd., Carbon Film, F.P. 1K ohm, 5%, ¼W	KOA RDF25S102J	515-0322	1
R3,60	2	Res., Fxd., Metal Oxide 68K ohm, 5%, 2W	KOA RSF-2B683J	515-0235	1
R4,10	2	Res., Fxd., Carbon Film, F.P. 56K ohm, 5%, ½W	KOA RDF50S563J	515-0329	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
R5,64	2	Res., Fxd., Carbon Film, F.P. 220K ohm, 5%, ½W	KOA RDF50S224J	515-0391	1
R6	1	Res., Fxd., Carbon Film, F.P. 5.6K ohm, 5%, ¼W	KOA RDF25S562J	515-0333	1
R7,8	2	Res., Fxd., Carbon Film, F.P. 220K ohm, 5%, ¼W	KOA RDF25S224J	515-0314	1
R9,12,13, 39,40,48	6	Res., Fxd., Carbon Film F.P. 10K ohm, 5%, ¼W	KOA RDF25S103J	515-0331	1
R11	1	Res., Fxd., Carbon Film F.P. 750 ohm, 5%, ½W	KOA RDF50S751J	515-0390	1
R14,23	2	Res., Fxd., Carbon Film F.P. 2.7K ohm, 5%, ¼W	KOA RDF25S272J	515-0340	1
R15	1	Res., Fxd., Carbon, Film 330 ohm, 5%, ¼W	Matsushita ERD-25TJ331	515-0093	1
R16	1	Res., Fxd., Metal Film 2.7K ohm, 1%, ¼W	Nikkohm RN-131272F	515-0218	1
R17	1	Res., Fxd., Carbon Film 22K ohm, 5%, ¼W	Matsushita ERD-25TJ223	515-0169	1
R18,27	2	Res., Variable, Trim 2K ohm, 20%, ½W	Copal RJ-6X-202	515-0115	1
R19	1	Res., Fxd., Metal Film 1.5K ohm, 1%, ¼W	Nikkohm RN-131152F	515-0175	1
R20	1	Res., Fxd., Metal Film 3.6K ohm, 1%, ¼W	Nikkohm RN-131362F	515-0126	1
R21	1	Res., Fxd., Carbon Film 3.3K ohm, 5%, ¼W	Matsushita ERD-25TJ332	515-0047	1
R22	1	Res., Fxd., Carbon Film 18K ohm, 5%, ¼W	Matsushita ERD-25TJ183	515-0083	1
R24	1	Res. Fxd., Carbon Film 750 ohm, 5%, ¼W	Matsushita ERD-25TJ751	515-0076	1
R29,32,33, 41,43	5	Res., Fxd., Carbon Film 4.7K ohm, 5%, ¼W	Matsushita ERD-25TJ472	515-0053	1
R30	1	Res., Fxd., Carbon Film 15K ohm, 5%, ¼W	Matsushita ERD-25TJ153	515-0108	1
R31	1	Res., Fxd., Carbon Film 8.2K ohm, 5%, ¼W	Matsushita ERD-25TJ822	515-0149	1
R34	1	Res., Variable, Trim 5K ohm, 20%, ½W	Copal RJ-6X-502	515-0075	1
R35	1	Res., Fxd., Carbon, Film 390 ohm, 5%, ¼W	Matsushita ERD-25TJ391	515-0044	1
R36	1	Res., Fxd., Carbon Film 3.9K ohm, 5%, ¼W	Matsushita ERD-25TJ392	515-0074	1
R38	1	Res., Fxd., Carbon Film 39K ohm, 5%, ¼W	Matsushita ERD-25TJ393	515-0229	1
R42	1	Res., Fxd., Carbon Film 1.2K ohm, 5%, ¼W	Matsushita ERD-25TJ122	515-0084	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES KEPCO, INC.

KEPCO® REPLACEMENT PARTS LIST

MODEL RMX-D SERIES **COMMON PARTS LIST** **Code 08-1882**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
R44,45	2	Res., Fxd., Carbon Film 12K ohm, 5%, ¼W	Matsushita ERD-25TJ123	515-0054	1
R46,47	2	Res., Fxd., Metal Oxide 680 ohm, 5%, 1W	KOA RSF-1B681J	515-0200	1
R49,50	2	Res., Fxd., Metal Oxide 5.6 ohm, 5%, 2W	KOA RSF-2B5R6J	515-0230	1
R51,52	2	Res., Fxd., W.W., F.P. 2.2 ohm, 10%, 5W	Matsushita ERF-5AK2R2	515-0231	1
R53,54	2	Res., Fxd., Metal Oxide 30 ohm, 5%, 1W	KOA RSF-1B300J	515-0188	1
R55	1	Res., Fxd., Metal Oxide 220 ohm, 5%, 3W	KOA RSF-3B221J	515-0232	1
R61	1	Res., Fxd., Metal Oxide 82 ohm, 5%, 2W	KOA RSF-2B820J	515-0236	1
R62	1	Res., Fxd., Carbon Film 56 ohm, 5%, ¼W	Matsushita ERD-25TJ560	515-0164	1
R63	1	Res., Fxd., Carbon Film 10 ohm, 5%, ¼W	Matsushita ERD-25TJ100	515-0176	1
T1	1	Transformer, Auxiliary	TDK DT047UL	500-0328	1
T2,3	2	Transformer, Driver	TDK PT045UL	500-0329	1
T5	1	Transformer, Current Sensing	TDK CT006UL	500-0330	1

MISCELLANEOUS MECHANICAL PARTS

N.A.	2	Cover Plate, Top & Bottom	529-0012
N.A.	1	Cover, Right	529-0009
N.A.	1	Cover, Left	529-0010
TB1	1	Barrier Strip, 9 Term. (BS)	567-0003
N.A.	2	BS Shorting Link	572-0001
N.A.	2	BS Spacer	504-0010
N.A.	1	BS Insulator	589-0002
N.A.	9	BS Screw, Pan Head, BN, M4 x 6	501-0011
N.A.	2	BS Nut, M3, BN	502-0009
N.A.	2	BS Lock Washer	503-0006
N.A.	18	Cover Screws, M3 x 6 BN, Flat Head	501-0019
N.A.	2	Heavy-Duty Output Terminals	551-0001
N.A.	4	Nuts, M8, for Output Terminals	502-0008

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES KEPCO, INC.

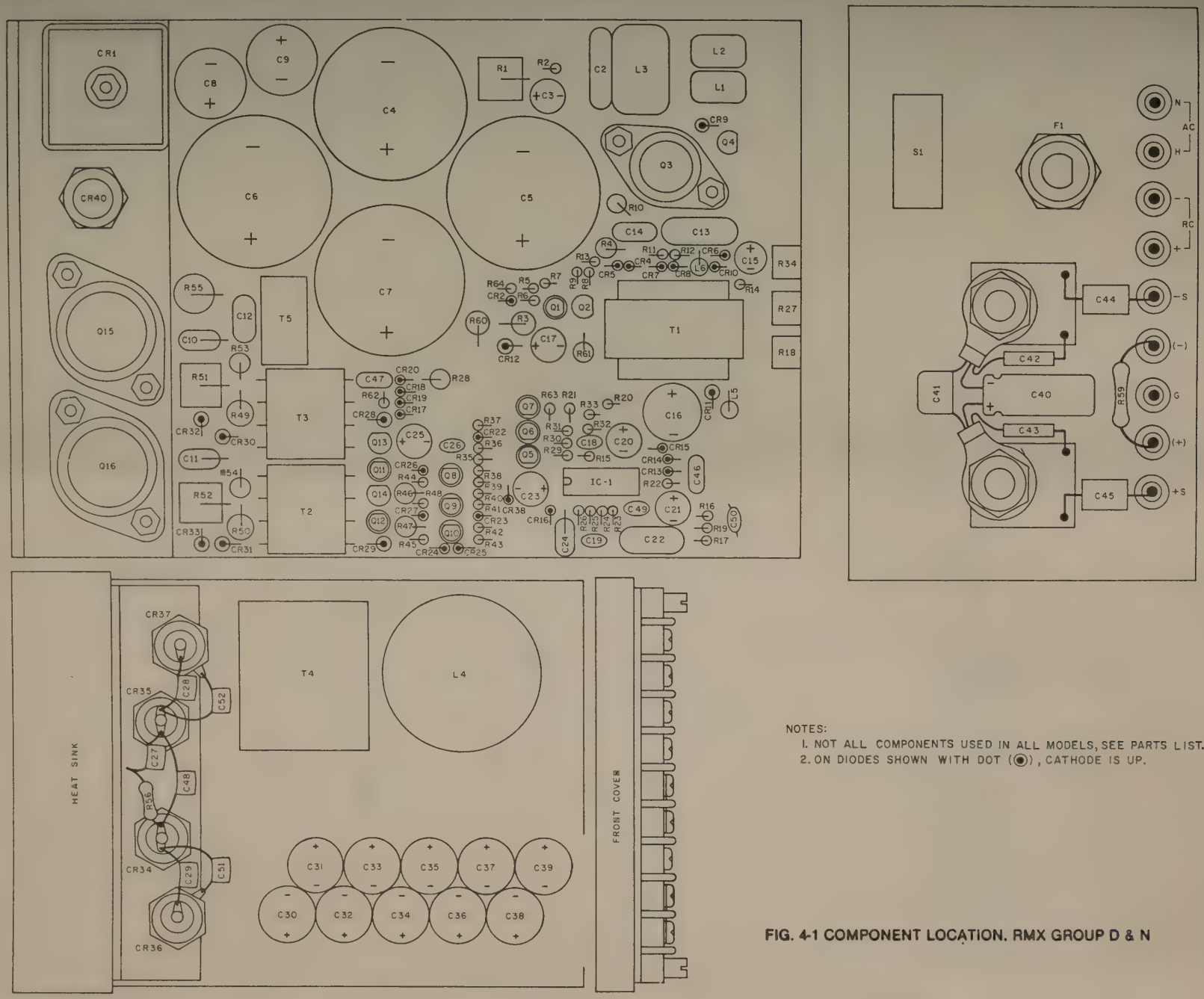
KEPCO. REPLACEMENT PARTS LIST

RMX 24–D | INDIVIDUAL PARTS LIST | Code 12-2679

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
C27	1	Cap., Fxd, Film, Rad. Leads 0.01uF, 10%, 600V	Matsushita ECQ-F6103KZ	517-0166	1
C30,31,32, 33,34,35,36, 37,38,39	10	Cap., Elect., S-End Leads 470uF, +50 -10%, 50V	Nippon Chemi-Con SX50VB470	517-0163	2
C40	1	Cap., Elect., S-End Leads 470uF, 20%, 35V	Nippon Chemi-Con KX35VB470	517-0154	1
CR22	1	Diode, Zener, Ax. Leads 13V, 3%, 0.5W	NEC RD13E ± 3%	521-0024	1
CR34,35	2	Diode, Rect., Switch, Stud Mt. 200V (PIV), 30A	Fuji ERE75-02	524-0036	1
L4	1	Choke, Filter, Output	TDK CH069UL	500-0322	1
R25	1	Res., Fxd, Metal Film 1.1k ohm, 1%, 0.25W	Nikkohm RN131112F	515-0238	1
R26	1	Res., Fxd, Metal Film 8.2k ohm, 1%, 0.25W	Nikkohm RN131822F	515-0239	1
R28	1	Res., Fxd, Carbon Film 390 ohm, 5%, 0.5W	Matsushita ERD-50TJ391	515-0237	1
R37	1	Res., Fxd, Carbon Film 10k ohm, 5%, 0.25W	Matsushita ERD-25TJ103	515-0055	1
R56	1	Res., Fxd, Metal Oxide 5.6 ohm, 5%, 2W	Koaohm RSF-2B5R6J	515-0230	1
R59	1	Res., Fxd, W.W. 330 ohm, 5%, 5W	Matsushita ERG-5CJ331	515-0070	1
T4	1	Transformer, Power	TDK MT161UL	500-0323	1

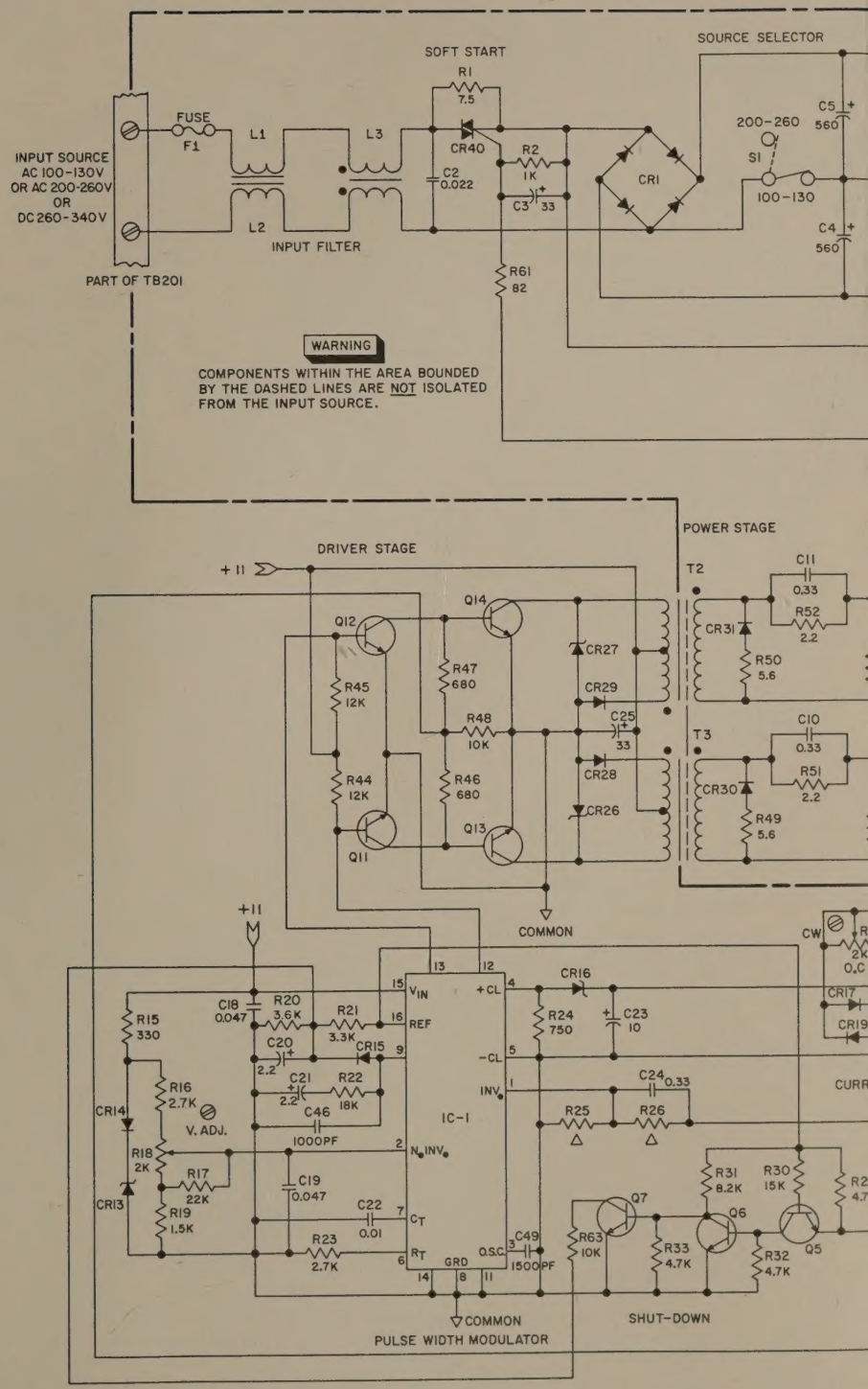
NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.



NOTES:
1. NOT ALL COMPONENTS USED IN ALL MODELS, SEE PARTS LIST.
2. ON DIODES SHOWN WITH DOT (◉), CATHODE IS UP.

FIG. 4-1 COMPONENT LOCATION. RMX GROUP D & N



KEPCO.

Data subject to change without notice.
PATENT NOTICE: Applicable Patent Numbers will be supplied on request.

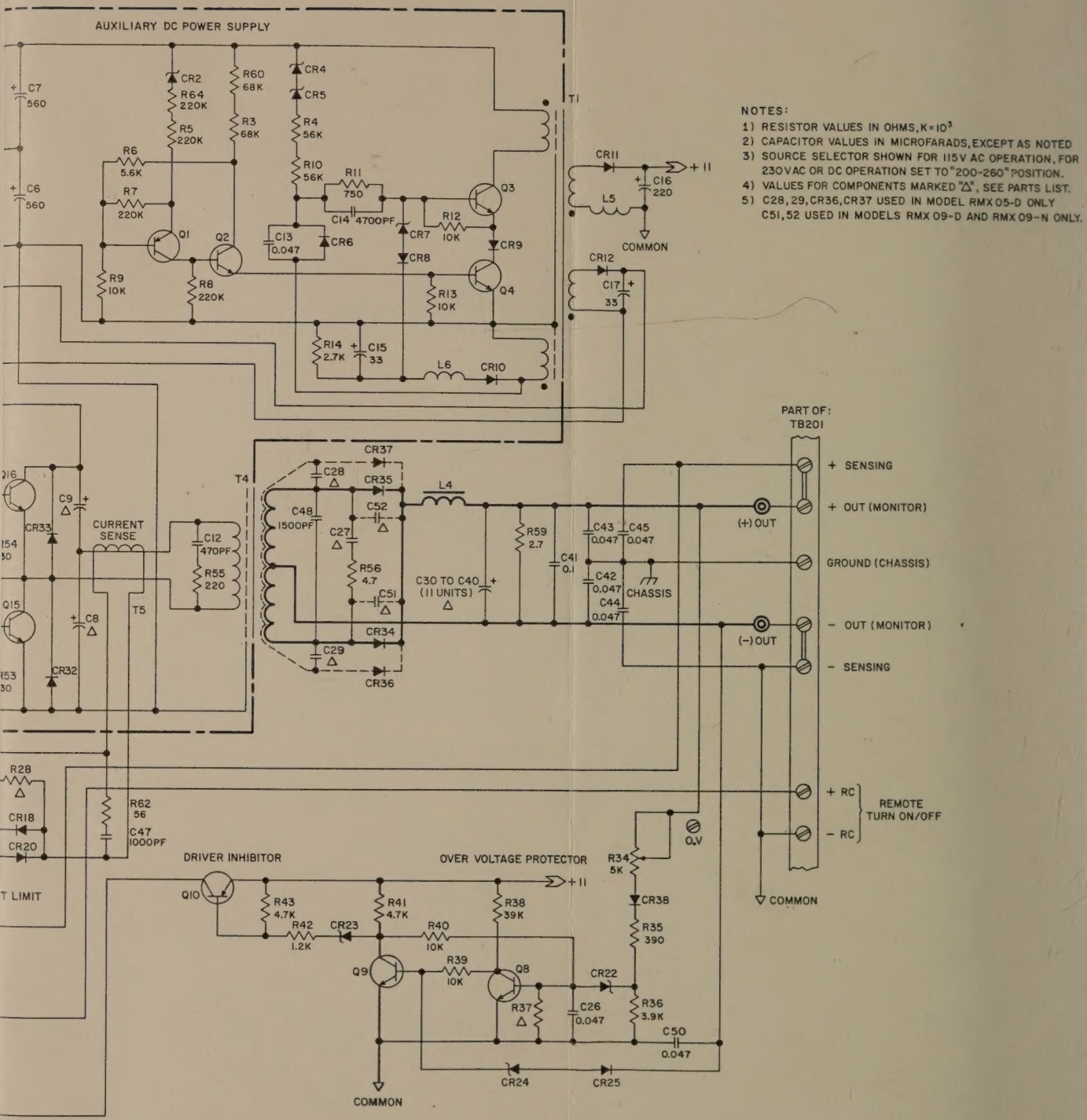


FIG. 4-2 MAIN SCHEMATIC. RMX D & N.